

I claim:

1. A method of determining the metabolism of one or more sugars or fatty acids in an individual, said method comprising:

(a) administering one or more compositions comprising one or more ^2H -labeled sugars or ^2H -labeled fatty acids to an individual;

(b) obtaining one or more bodily tissues or fluids at one or more times from said individual; and

(c) detecting the incorporation of said ^2H from said one or more ^2H -labeled sugars or ^2H -labeled fatty acids into water to determine the metabolism of said one or more sugars or fatty acids in said individual.

2. The method according to claim 1, wherein said one or more compositions comprise ^2H -labeled glucose.

3. The method according to claim 2, wherein said ^2H -labeled glucose is chosen from [6,6- $^2\text{H}_2$]glucose, [1- $^2\text{H}_1$]glucose, and [1,2,3,4,5,6- $^2\text{H}_7$]glucose.

4. The method according to claim 1, wherein said one or more compositions are administered by a technique chosen from oral, gavage, intraperitoneal, intravascular, and subcutaneous administration.

5. The method according to claim 4, wherein said one or more compositions are administered orally.

6. The method according to claim 1, wherein said individual is a mammal.

7. The method according to claim 6, wherein said mammal is chosen from humans, rodents, primates, hamsters, guinea pigs, dogs, and pigs.

8. The method according to claim 7, wherein said mammal is a human.
9. The method according to claim 1, wherein said one or more bodily tissues or fluids are chosen from blood, urine, saliva, and tears.
10. The method of claim 1, wherein said one or more bodily tissues or fluids are chosen from liver, muscle, adipose, intestine, brain, and pancreas.
11. The method of claim 1, comprising the additional step of partially purifying said water.
12. The method of claim 11, comprising the additional step of isolating said water.
13. The method according to claim 1, comprising the additional step of measuring ^2H incorporation or incorporation ratio into one or more chemical compositions chosen from glucose, glycogen, glycerol-triglyceride, triglyceride fatty acid, proteins, and DNA.
14. The method according to claim 13, wherein said chemical composition is glucose.
15. The method according to claim 14, comprising the additional step of measuring endogenous glucose production.
16. The method according to claim 14, comprising the additional step of measuring the proportion of labeled glucose stored in tissue glycogen relative to said labeled sugar administered.
17. The method according to claim 14, comprising the additional step of measuring the proportion or rate of administered ^2H -glucose undergoing glycolysis.
18. The method according to claim 13, wherein said chemical composition is glycogen.

19. The method according to claim 13, wherein said chemical composition is glycerol-triglyceride.
20. The method according to claim 19, comprising the additional step of calculating new triglyceride synthesis.
21. The method according to claim 13, wherein said chemical composition is triglyceride fatty acid.
22. The method according to claim 21, comprising the additional step of calculating new fatty acid synthesis.
23. The method according to claim 13, comprising the additional step of calculating the proportion or storage rate of labeled fatty acids stored in tissue relative to labeled fatty acid administered.
24. The method according to claim 1, comprising the additional step of calculating the proportion or storage rate of administered labeled fatty acids undergoing fatty acid oxidation.
25. The method according to claim 13, wherein said chemical composition is a protein.
26. The method according to claim 13, wherein said chemical composition is DNA.
27. The method according to claim 24, comprising the additional step of calculating the rate or amount of DNA synthesis.
28. The method according to claim 1, further comprising calculating the rate or total amount of incorporation of said ^2H into said water.

29. The method according to claim 13, further comprising calculating the rate of or amount incorporation of ^2H into said one or more chemical compositions.
30. The method according to claim 28, further comprising calculating the rate of or amount incorporation of ^2H into said one or more chemical compositions.
31. The method according to claim 1, wherein said water is detected by methods chosen from gas chromatography/mass spectrometry, liquid chromatography-mass spectrometry, gas chromatography-pyrolysis-isotope ratio/mass spectrometry, gas chromatography-combustion-isotope ratio/mass spectrometry, cycloidal mass spectrometry, Fourier-transform-isotope ratio (IR)-spectroscopy, near IR laser spectroscopy, and isotope ratio mass spectrometry.
32. The method according to claim 1, wherein said detecting step may be accomplished by detecting one part ^2H in 10^7 parts water.
33. A method of identifying the effect of a drug agent on an individual, comprising:
administering a drug agent to the individual; \times
determining the metabolism of one or more sugars or fatty acids in the individual according to claim 1 to identify the effect of said drug agent on said individual.
34. The method according to claim 1, wherein said metabolism determination is used as a surrogate marker for FDA approval of drugs.
35. The method according to claim 1, wherein said metabolism determination is used for the clinical management of patients.
36. A method of diagnosing insulin resistance or diabetes mellitus, comprising:
determining the metabolism of one or more sugars or fatty acids according to claim 1.

37. The method according to claim 1, wherein said metabolism determination is chosen from identifying individuals at risk for insulin resistance and diabetes mellitus.
38. The method according to claim 1, wherein said metabolism determination further comprises diagnosing high-fat diet-induced obesity.
39. The method according to claim 1, wherein said metabolism determination further comprises identifying individuals at risk for high-fat diet-induced obesity.
40. The method according to claim 1, wherein said metabolism determination further comprises the step chosen from monitoring the effects of interventions to prevent or reverse insulin resistance, diabetes mellitus and high-fat diet-induced obesity.
41. The method according to claim 1, comprising the further step chosen from diagnosing and treating wasting disorders.
42. The method according to claim 1, comprising the further step chosen from diagnosing and treating hypoglycemia.
43. The method according to claim 1, comprising the further step chosen from diagnosing and treating glycogen storage disease.
44. A kit for determining the metabolism of a sugar in an individual comprising:
 - a) one or more labeled sugars,
 - b) instructions for use of the kit,wherein the kit is used to determine sugar metabolism in said individual.
45. The kit of claim 44 further comprising chemical compounds for isolating water.

46. The kit of claim 44 further comprising chemical compounds for isolating a composition chosen from glucose, glycogen, proteins, and DNA.
47. The kit of claim 44 further comprising a tool for administering labeled glucose.
48. The kit of claim 44 further comprising an instrument for collecting a sample from the subject.
49. A drug agent the effect of which was at least partially identified by the method of claim 33.
50. An isotopically perturbed molecule chosen from glycogen, glycerol-triglyceride, triglyceride fatty acid, proteins, and DNA.
51. The method according to claim 33, further comprising the manufacturing of one or more drug agents at least partially identified by said method.
52. An information storage device comprising data obtained from the method according to claim 1.
53. The device of claim 52, wherein said device is a printed report.
54. The printed report of claim 53, wherein the medium in which said report is printed on is chosen from paper, plastic, and microfiche.
55. The device of claim 52, wherein said device is a computer disc.
56. The disc of claim 55, wherein said disc is chosen from a compact disc, a digital video disc, and a magnetic disc.

57. The device of claim 52, wherein said device is a computer.
58. / An information storage device comprising data obtained from the method according to claim 33.
59. An isotopically-perturbed molecule produced by the method according to claim 1.
60. / A kit for determining the metabolism of a fatty acid in an individual comprising:
a) one or more labeled fatty acids, and
b) instructions for use of the kit,
wherein the kit is used to determine fatty acid metabolism in said individual.
61. The kit of claim 44 further comprising chemical compounds for isolating water.
62. The kit of claim 44 further comprising chemical compounds for isolating a composition chosen from glycerol-triglyceride, triglyceride-fatty acid, proteins, and DNA.
63. The kit of claim 44 further comprising a tool for administering labeled fatty acids.
64. The kit of claim 44 further comprising an instrument for collecting a sample from the subject.
65. At least one isolated deuterated water molecule ($^2\text{H}_2\text{O}$), produced by the method according to claim 1.
66. At least one isolated deuterated water molecule ($^2\text{H}_2\text{O}$), produced by the method according to claim 33.